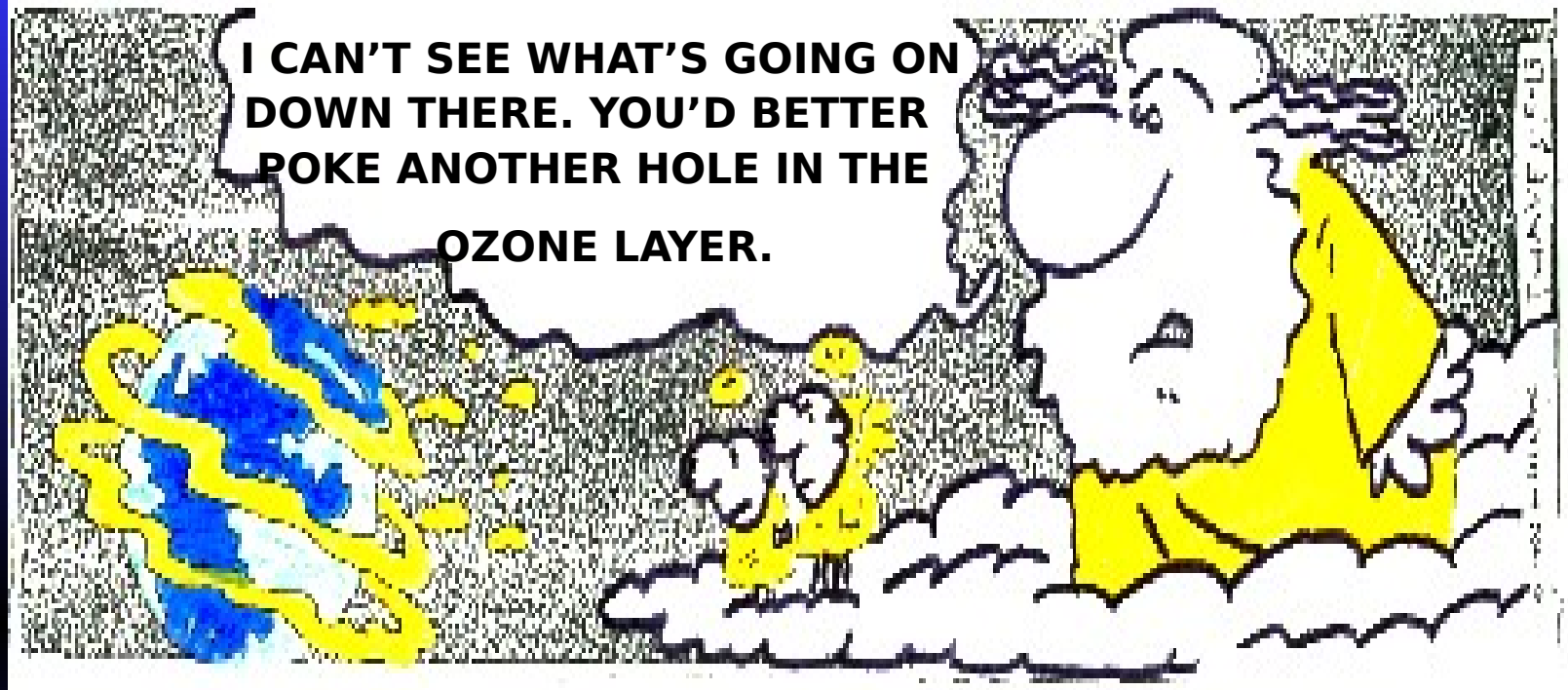
Installed Halon Systems



HALON IS A SEVERE OZONE DEPLETING SUBSTANCE

HALON

- MONTREAL PROTOCOL OF 1987
  - **ALL** HALON PRODUCTION CEASED AS OF JAN 1994
  - IN 1996, THE US NAVY HAD 1.6 MILLION LBS OF HALON 1301 IN STORAGE (ENOUGH TO LAST 30 YEARS)
- ALTERNATIVES
  - FM-200
  - HIGH PRESSURE WATER MIST

HALON

- HOW TO GET (AND GET RID OF) HALON 1301
  - COMNAVSUPSYSCOM MECHANICSBURG 111211Z AUG 99 IDENTIFIED DSC RICHMOND AS THE ODS RESERVE CENTRAL POINT OF ISSUE
  - REPLACEMENT AGENT IS AVAILABLE FREE OF CHARGE

HALON

- **1 1** - NUMBER OF CARBON ATOMS
- **3 2** - NUMBER OF FLUORINE ATOMS
- **0 1** - NUMBER OF CHLORINE ATOMS
- **1 1** - NUMBER OF BROMINE ATOMS

ONE REPORTED FATALITY FROM "HUFFING" HALON 1211 ONBOARD A CV!

TYPES OF HALON

- HALON 1211
  - USED PRIMARILY ON FLIGHT AND HANGAR DECKS ON CV AND BIG DECK AMPHIBS
  - ALSO FOUND IN LCACs AND MHCs
  - NOT USED IN TOTAL FLOODING SYSTEMS
  - HIGH LIQUID DENSITY ALLOWS ITS USE IN PORTABLE EXTINGUISHERS

HALON 1301

- CHARACTERISTICS
  - EXTINGUISHES FIRE BY INTERRUPTING THE UNINHIBITED CHAIN REACTION OF COMBUSTION
  - COLORLESS, ODORLESS
  - 5 TIMES DENSER THAN AIR
  - NON-CONDUCTIVE

HALON 1301

- ADVANTAGES
  - VERY EFFECTIVE ON LARGE CLASS “B” FIRES
  - SPACE CLEAN UP IS EASY
  - EASILY MAINTAINED
  - SAFER THAN CO_2 FLOODING SYSTEM

HALON 1301

- DISADVANTAGES
  - SEVERE OZONE DEPLETING POTENTIAL
  - INEFFECTIVE AGAINST CLASS “D” FIRES
  - **TOXIC IN DECOMPOSED STATE**
    - WHEN EXPOSED TO TEMPS >900^{0}F
      - HYDROGEN FLUORIDE, HYDROGEN BROMIDE (NO MORE DANGEROUS THAN NORMAL BYPRODUCTS OF COMBUSTION IN FIRE AFFECTED SPACE)

HALON 1301

- SLIGHTLY TOXIC IN NON-DECOMPOSED STATE
  - UP TO 7% CONCENTRATION
    - MINIMAL NERVOUS SYSTEM EFFECTS
  - 7-10% CONCENTRATION
    - DIZZINESS/TINGLING OF EXTREMITIES, INDICATIVE OF MILD ANESTHESIA

HALON 1301

- SLIGHTLY TOXIC IN NON-DECOMPOSED STATE
  - >10% CONCENTRATION
    - PRONOUNCED DIZZINESS / POSSIBLE UNCONSCIOUSNESS
  - No significant adverse health effects have been reported from the use of HALON 1301 as a fire extinguishing agent since it was introduced approx. 30 years ago

USS GARY (FFG-51)
CLASS B FIRE #2 SSDG ENCLOSURE

- Underway Operations Arabian Gulf 24 September 1995
- Initally reported as Class B fire, then identified as Class A . When extinguished, fire determined to be Class C fire.
- Activation of primary Halon from CCS failed due to faulty time delay.

USS GARY (FFG-51)
CLASS B FIRE #2 SSDG ENCLOSURE

- Order to bypass time delay not accomplished, fireteam failed to hear order.
- DCA ordered release of reserve Halon, attempt to do so was unsuccessful due to mislabeled actuator bottles in CCS. (18M-4R) not properly accomplished in 2nd QTR 1995.

USS GARY (FFG-51)
CLASS B FIRE #2 SSDG ENCLOSURE

- CCS reported 600 PSI on **all** bottles, prompting 2 more attempts to release Halon. Both attempts fail, third attempt succeeds when time delay is bypassed and reserve agent (labeled primary) is released.
- Number 1 AFFF Station failed due to electrical ground.

USS GARY (FFG-51)
CLASS B FIRE #2 SSDG ENCLOSURE

- Number 2 AFFF Station without power due to electrical isolation. Casualty power rigged but not energized due to concerns about overloading only operating diesel.
- ALL power lost throughout ship due to loss of only online generator.

USS GARY (FFG-51)
CLASS B FIRE #2 SSDG ENCLOSURE

- Equipment Problems:
  - 22 of 27 lights on firefighting helmets failed to operate.
  - Crew members attempted to load OBA canisters improperly.
  - P-250s failed to operate.

HALON 1301

- AGENT APPLICATION
  - MAIN ENGINEERING SPACES
  - FLAMMABLE LIQUID STOREROOMS
  - SSDG/GTG/GTM ENCLOSURES
  - 5-7% CONCENTRATION IN MANNED SPACES
  - 18-20% CONCENTRATION IN UNMANNED SPACES

HALON 1301

- MANUFACTURERS
  - ANSUL
  - KIDDE
- **ANSUL VALVE ACTUATORS WILL FIT KIDDE BOTTLES BUT WILL NOT DISCHARGE HALON**
- **KIDDE VALVE ACTUATORS WILL NOT FIT ANSUL BOTTLES**

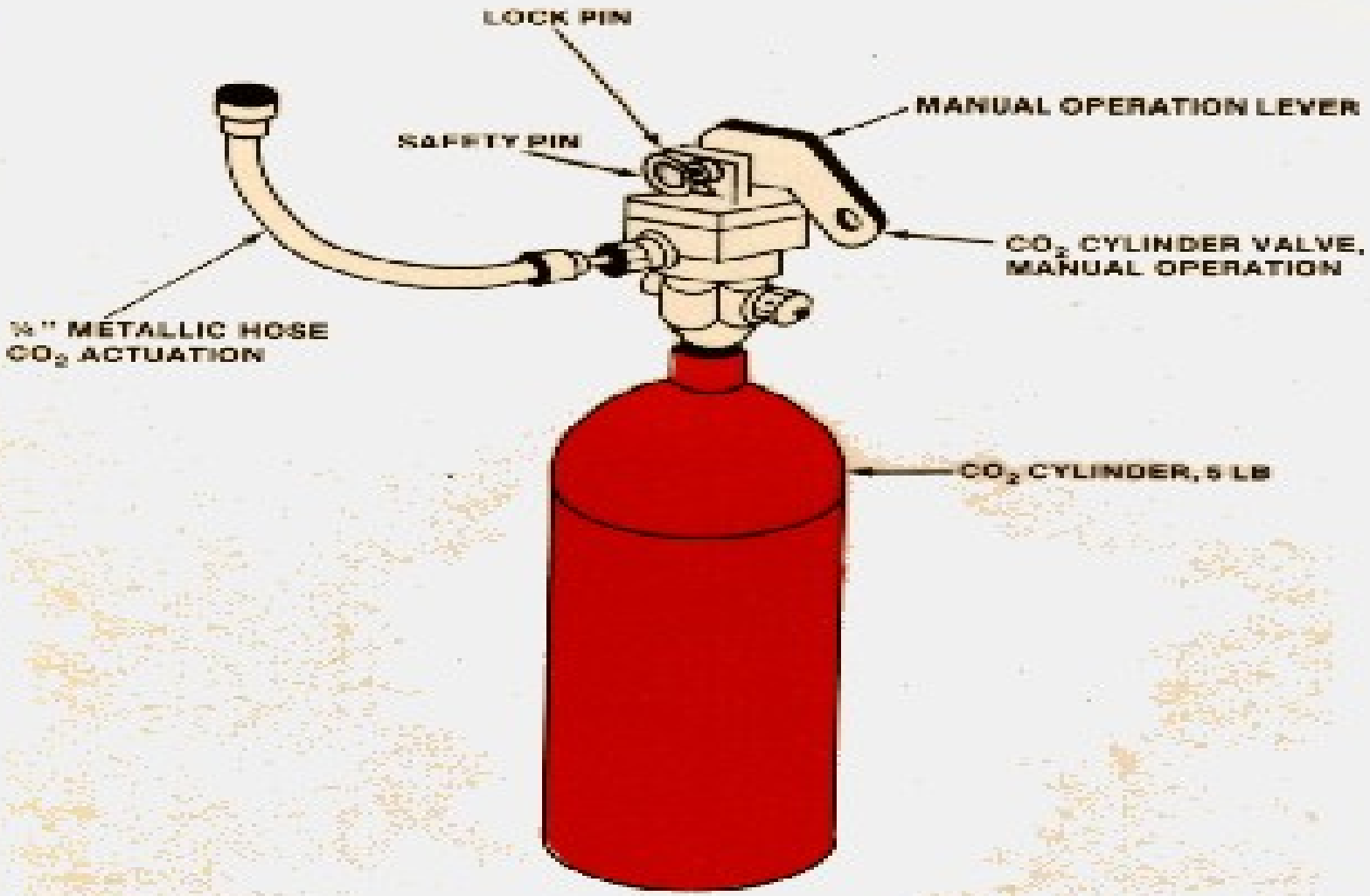
HALON 1301

- SYSTEM DESIGNS
  - MODULAR - ONE NOZZLE FOR EACH HALON BOTTLE
  - BANK I - ONE BANK OF CYLINDERS LOCATED IN PROTECTED SPACE
  - BANK II - PRIMARY/SECONDARY BANKS LOCATED IN PROTECTED SPACE
  - BANK III - PRIMARY/SECONDARY BANKS LOCATED IN A SEPARATE ROOM (SERVES MORE THAN ONE SPACE)

HALON 1301 SYSTEM COMPONENTS

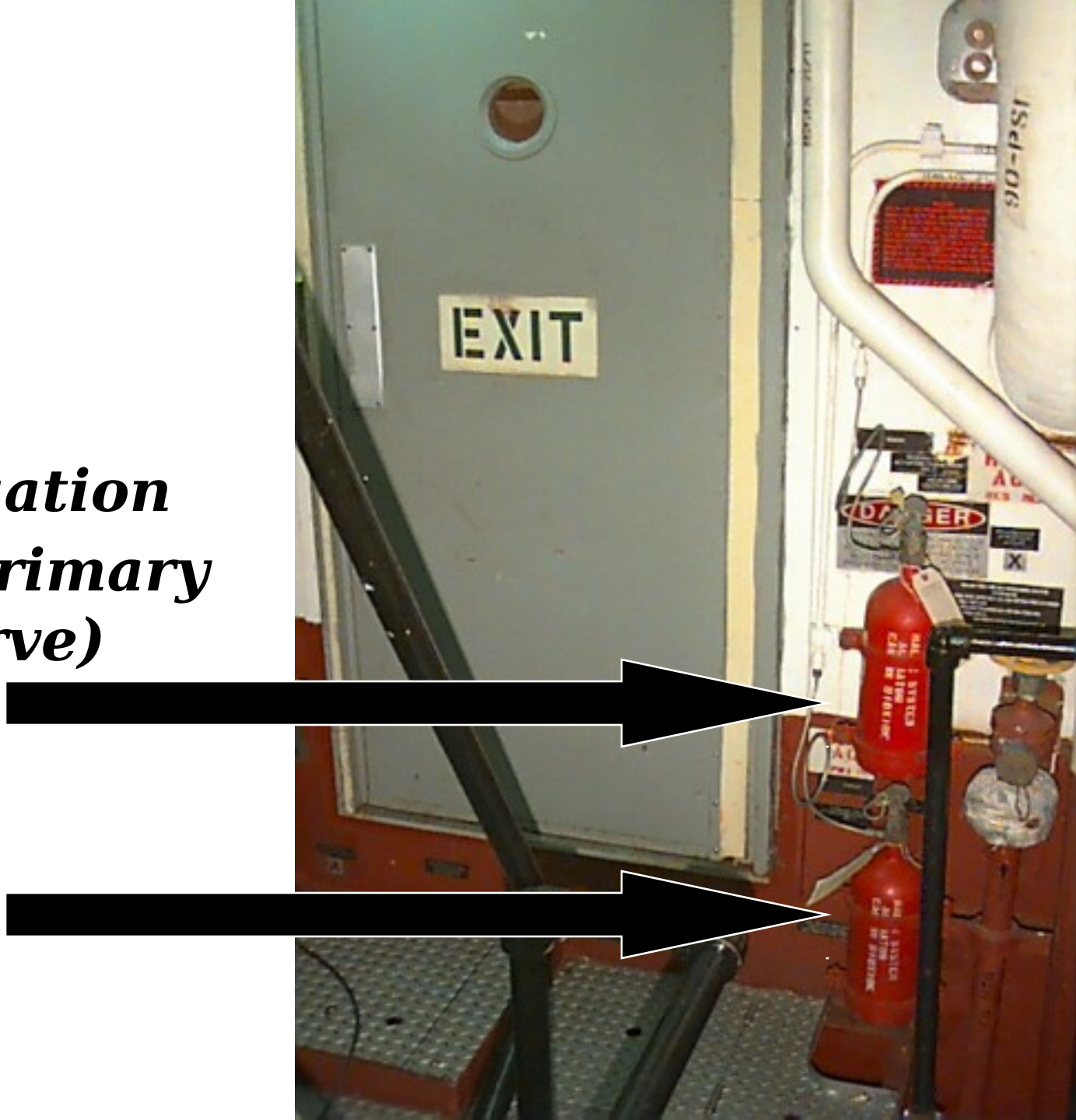
- CO_2 ACTUATION CYLINDER
  - 5 LB CHARGE OF CO_2
  - PROVIDES MOTIVE FORCE FOR SYSTEM ACTIVATION
  - DISCHARGES THROUGH CUNi TUBING AND A CHECK VALVE INTO THE CO_2 ACTUATION MANIFOLD

CO_2 ACTUATION CYLINDER



MANUAL

CO_2 Actuation bottles (Primary / Reserve)



HALON 1301 SYSTEM COMPONENTS

- CO_2 ACTUATION PIPING VENT
  - 1/32” VENT HOLE THAT ALLOWS FOR CO_2 PRESSURE TO VENT OFF AND ENABLE RESETTING OF PRESSURE SWITCHES

HALON 1301 SYSTEM COMPONENTS

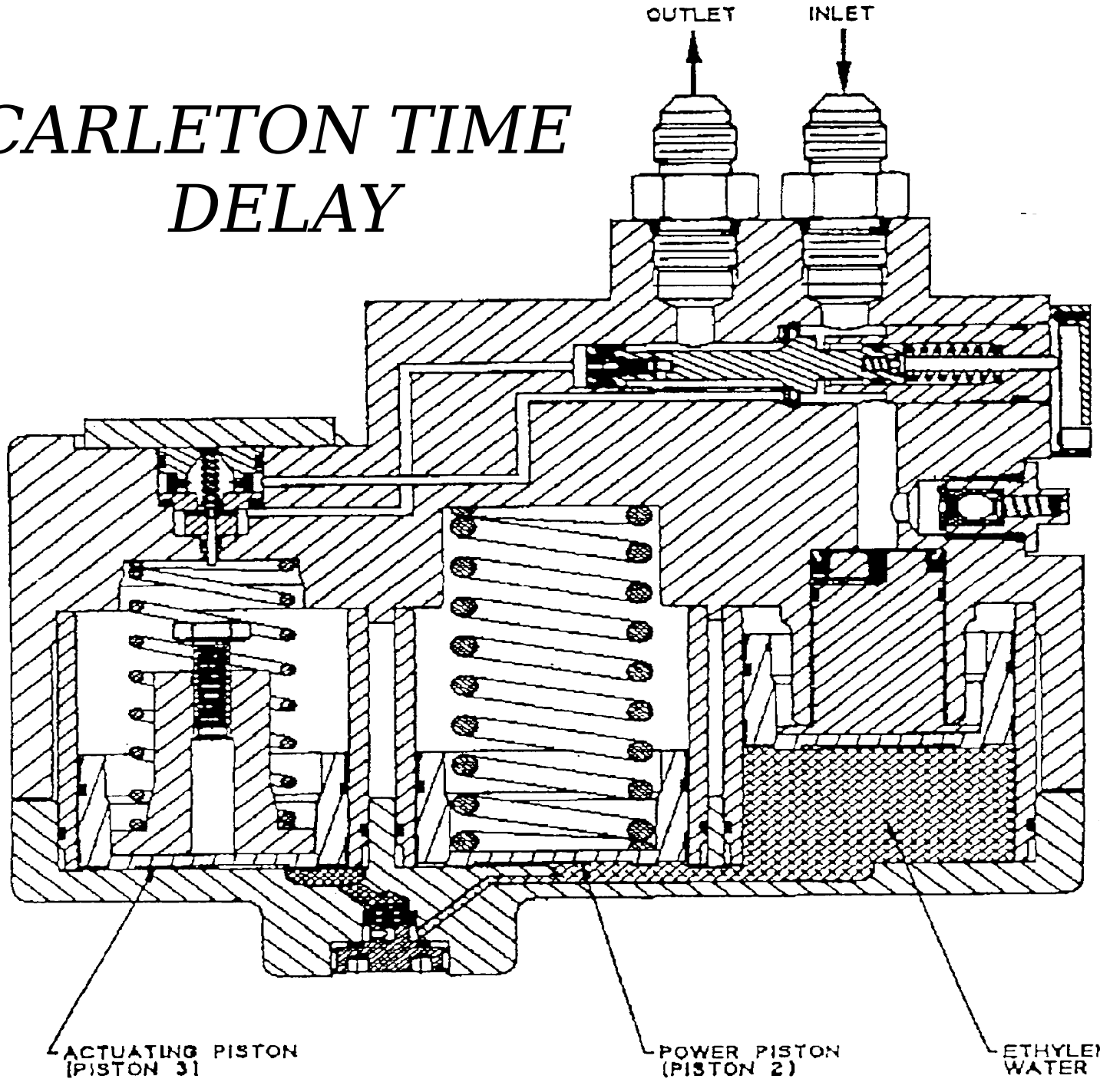
- DISCHARGE TIME DELAY DEVICE (TDD)
  - ALLOWS TIME FOR PERSONNEL TO SECURE COMPARTMENT ACCESSES
  - ALLOWS VENTILATION TIME TO "COAST DOWN"
  - MACHINERY SPACE = 60 SECONDS
  - NON-MACHINERY SPACE = 30 SECONDS

HALON 1301 SYSTEM COMPONENTS

- DISCHARGE TIME DELAY DEVICE (TDD)
  - CARLETON TIME DELAY ONLY AUTHORIZED MODEL
  - CARLETON TIME DELAY IS NOT REPAIRABLE BY SHIP'S FORCE (CNSL 210500ZSEP96)
  - PMS ALLOWS FOR 60 PLUS OR MINUS 10 SECONDS / 30 PLUS OR MINUS 5 SECONDS

TIME DELAY

CARLETON TIME DELAY



HALON 1301 SYSTEM COMPONENTS

- TIME DELAY DEVICE BYPASS VALVE
  - NORMALLY CLOSED BALL VALVE; CIRCLE X-RAY CLASSIFICATION (SHOULD BE ON CCOL)
  - OPERATED WHEN TDD FAILS TO OPERATE OR TIME TO DISCHARGE EXCEEDS 70 SECONDS FOR A MAIN MACHINERY SPACE

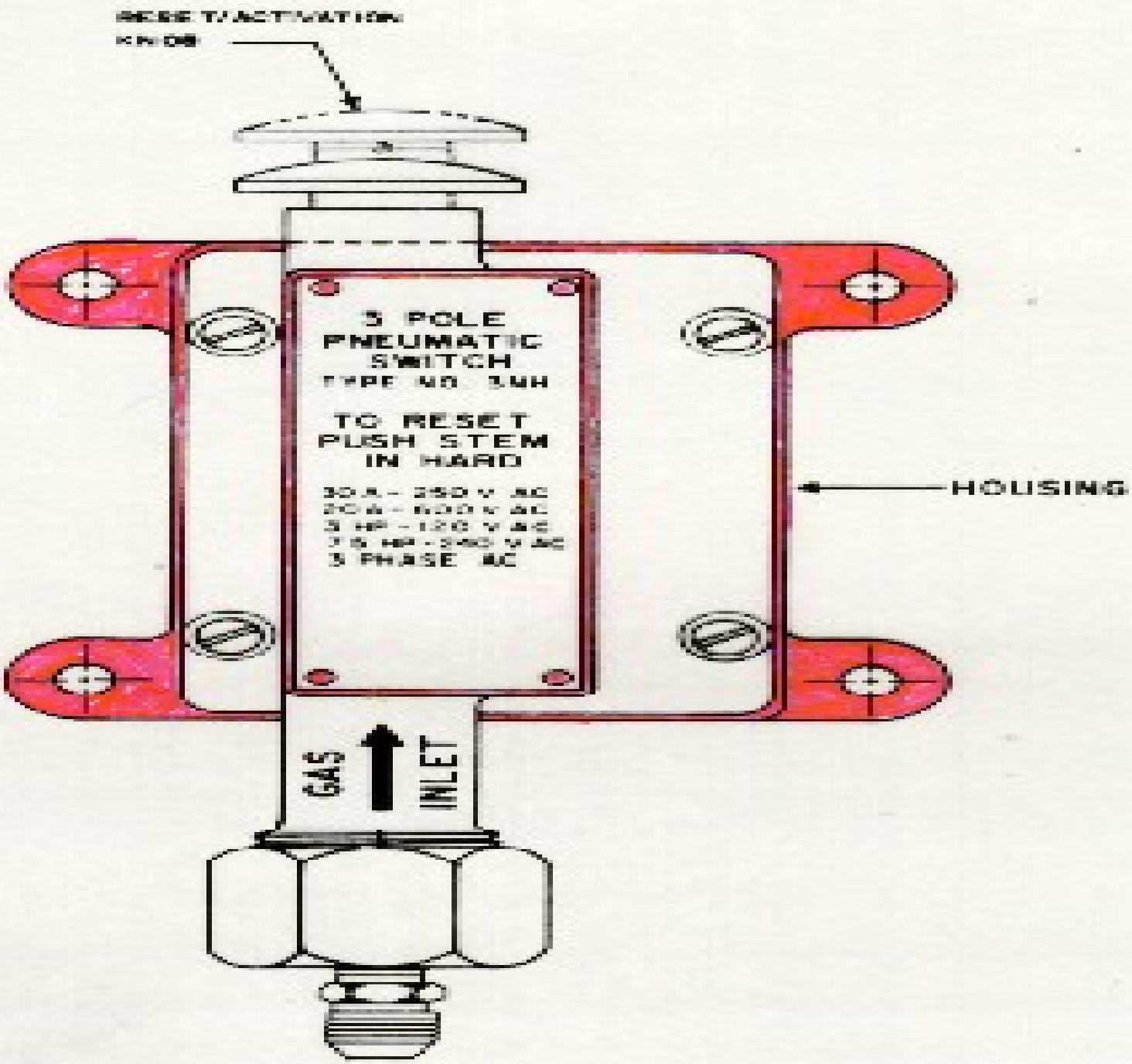
HALON 1301 SYSTEM COMPONENTS

- TIME DELAY DEVICE BYPASS VALVE
  - USED WHEN APPLYING HALON AFTER SPACE EVACUATION HAS BEEN EFFECTED WHEN ALL ACCESSES ARE SECURED AND VENTILATION IS STOPPED

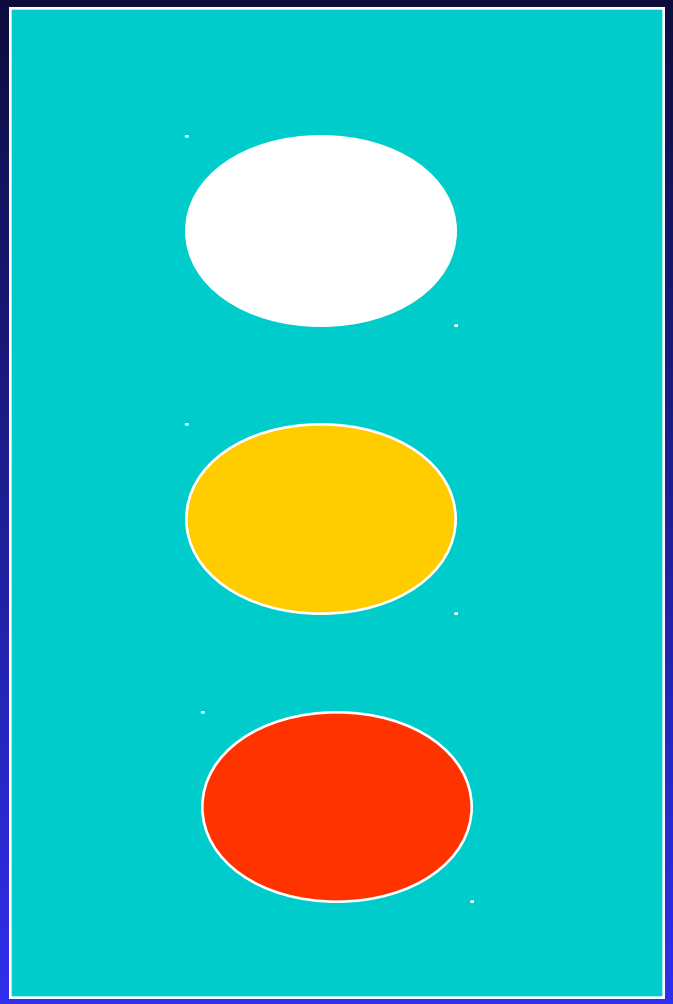
HALON 1301 SYSTEM COMPONENTS

- PRESSURE SWITCHES (3)
  - ALARM / INDICATOR SWITCH
    - SOUNDS ALARM IN PROTECTED SPACE AS WELL IN CONTROLLING STATIONS
    - ENERGIZES ROTATING BEACONS IN PROTECTED SPACE
  - VENT SHUTDOWN SWITCH
  - HALON RELEASE INDICATOR SWITCH
  - QUARTERLY TEST OF “BELLS AND WHISTLES”

PRESSURE SWITCH



HALON INDICATOR LIGHT PANEL

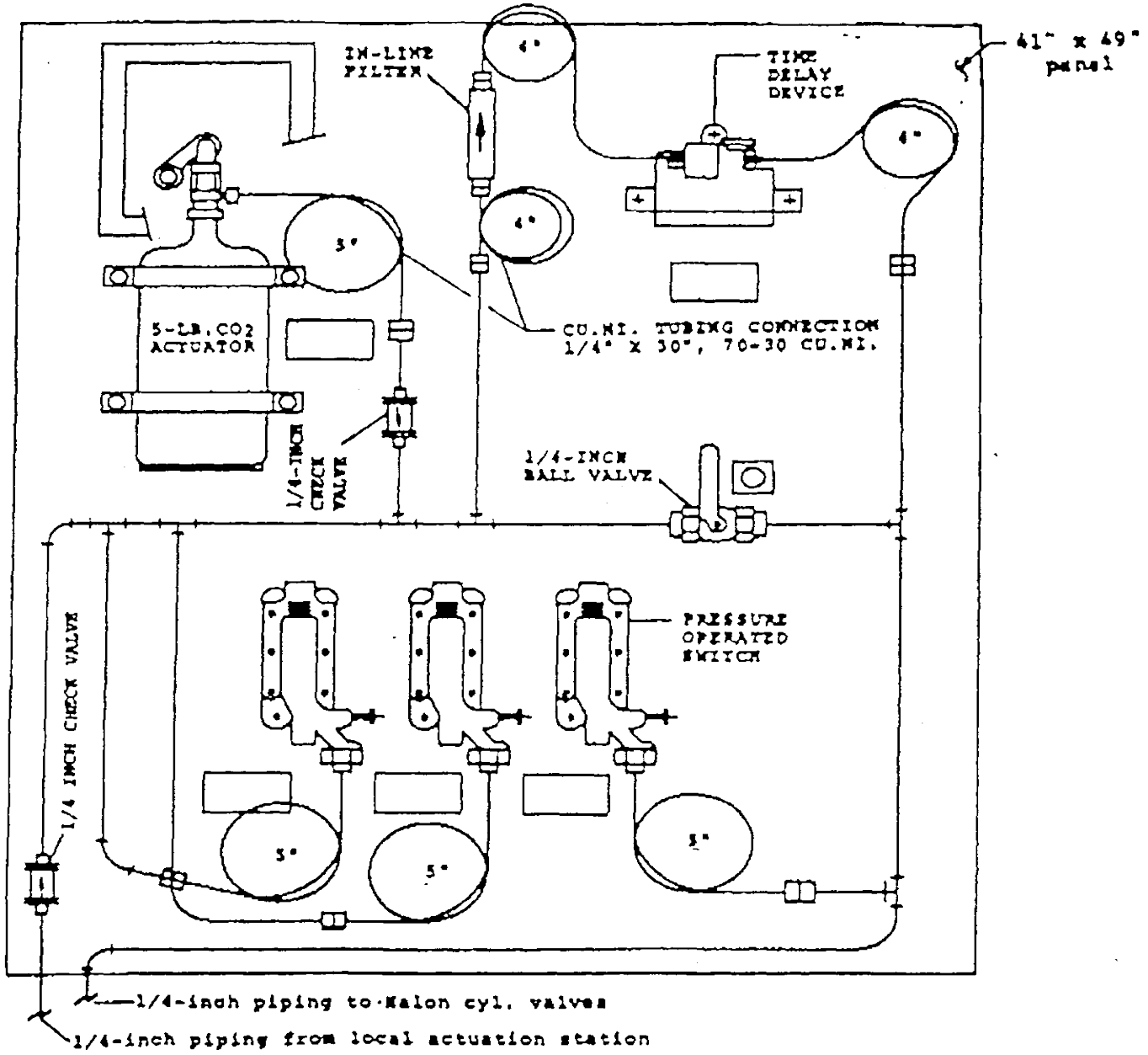


POWER AVAILABLE

SYSTEM ACTIVATED

HALON DISCHARGED

HALON SYSTEM



Pressure Switches

- ***Ventilation shutdown***

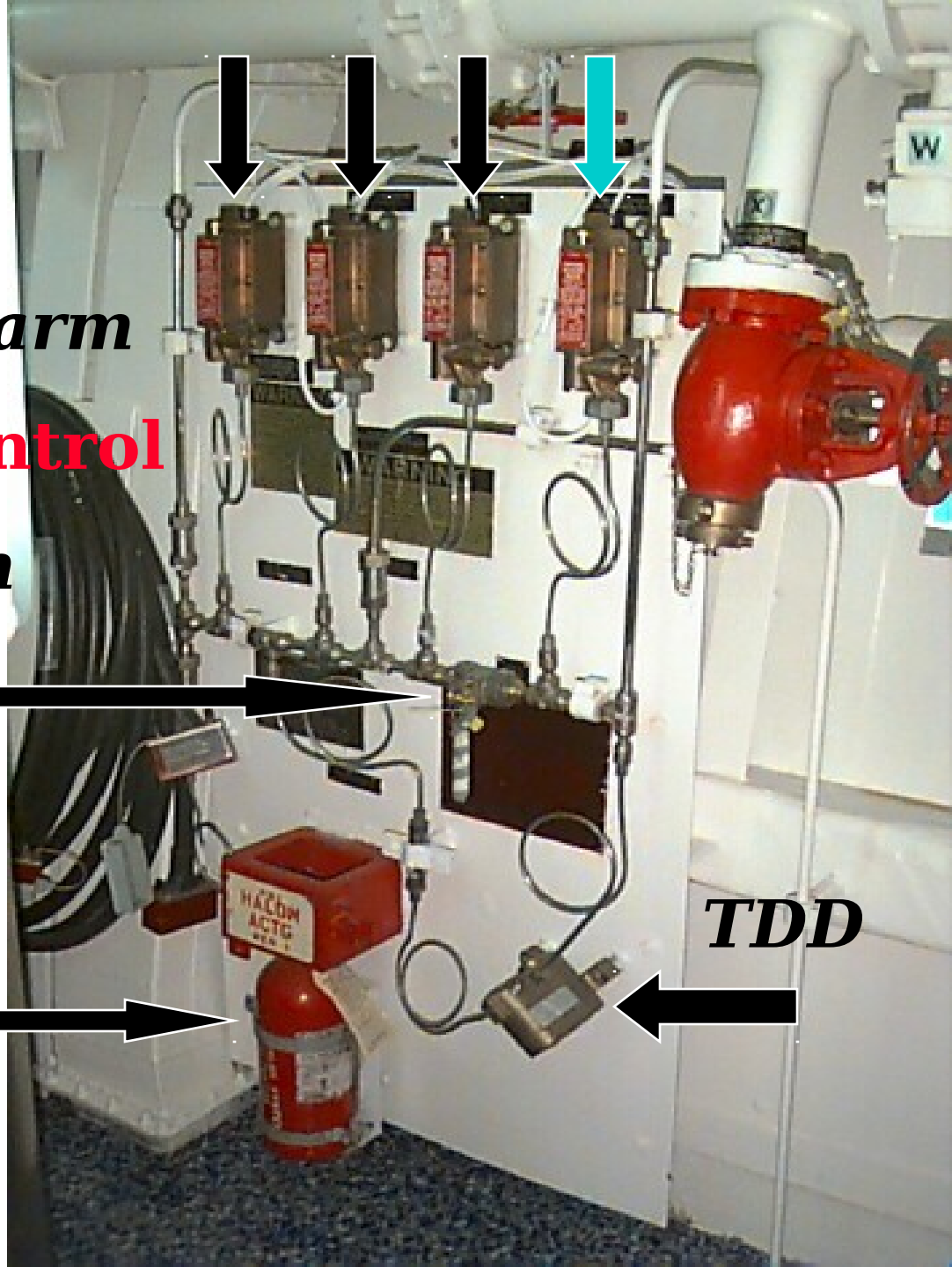
-***Pre-discharge Alarm***

- **Vent Damper control**

- ***Discharge Alarm***

TDD Bypass Valve

CO_2 Actuation Bottle



HALON 1301 SYSTEM COMPONENTS

- HALON CYLINDER
  - PRESSURIZED WITH NITROGEN TO 600-675 PSI AT 70^0F
  - COMES IN 10/15/60/95 AND 125 LB SIZES
  - NON-SHATTERABLE STEEL CYLINDERS
  - COLOR CODED RED WITH 3”WHITE STRIPE ABOVE 3” GRAY STRIPE

HALON 1301 SYSTEM COMPONENTS

- HALON CYLINDER
- PMS REQUIRES ULTRASONIC INSPECTION ON A SEMI ANNUAL BASIS
- CYLINDERS MUST BE WEIGHED UPON INITIAL RECEIPT / WHENEVER ULTRASONIC RESULTS INDICATE LIQUID LEVEL IS TOO LOW

Halon Cylinder Storeroom

(DDG 51 class)

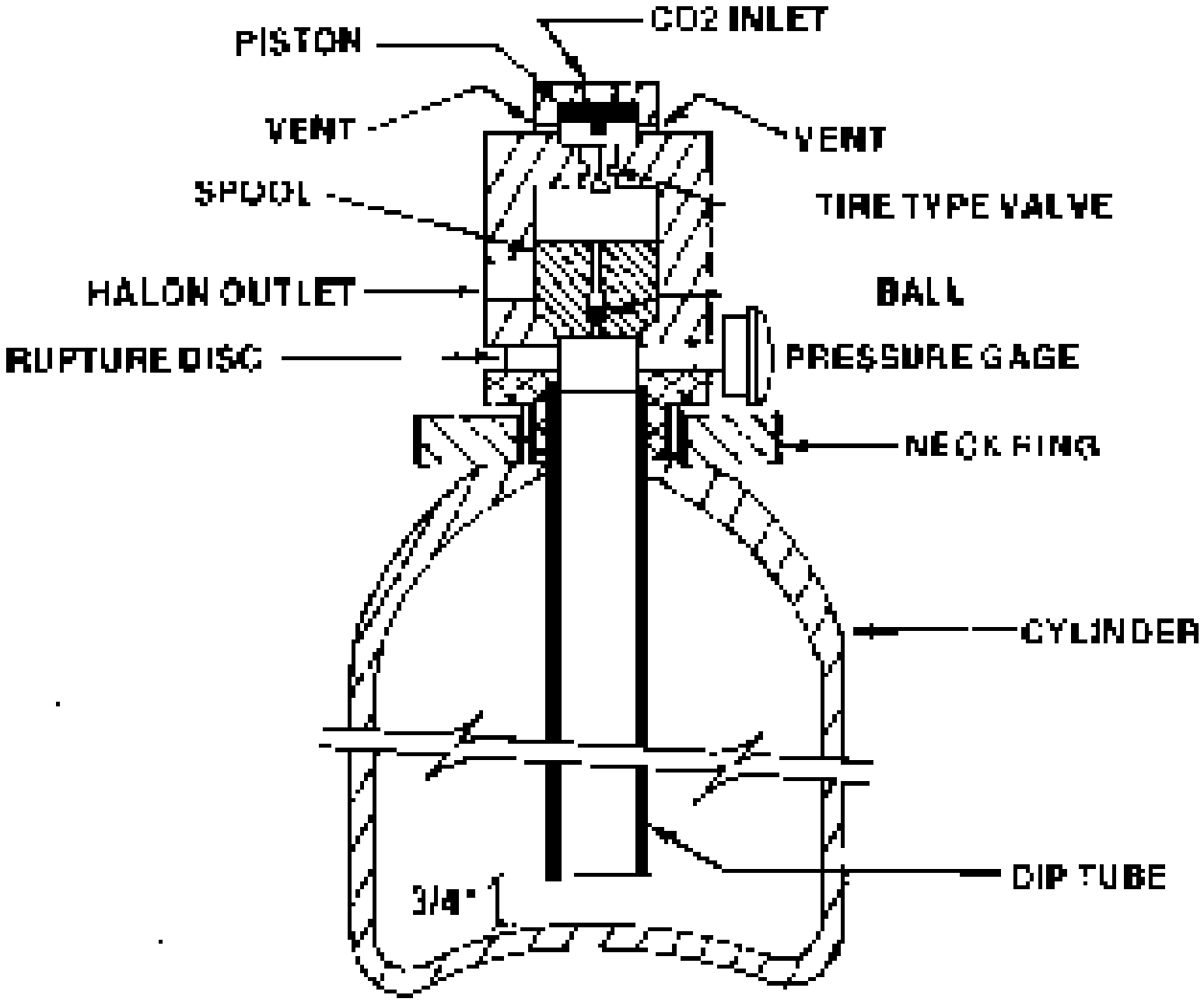
HALON 1301 SYSTEM COMPONENTS

- INSPECT CYLINDER VALVES / ACTUATORS
  - NAVSAFECEN SAFETY ADVISORY 14-95 DEFINES CRITICAL MEASUREMENTS TO IDENTIFY WHICH VALVE ACTUATORS ARE INSTALLED

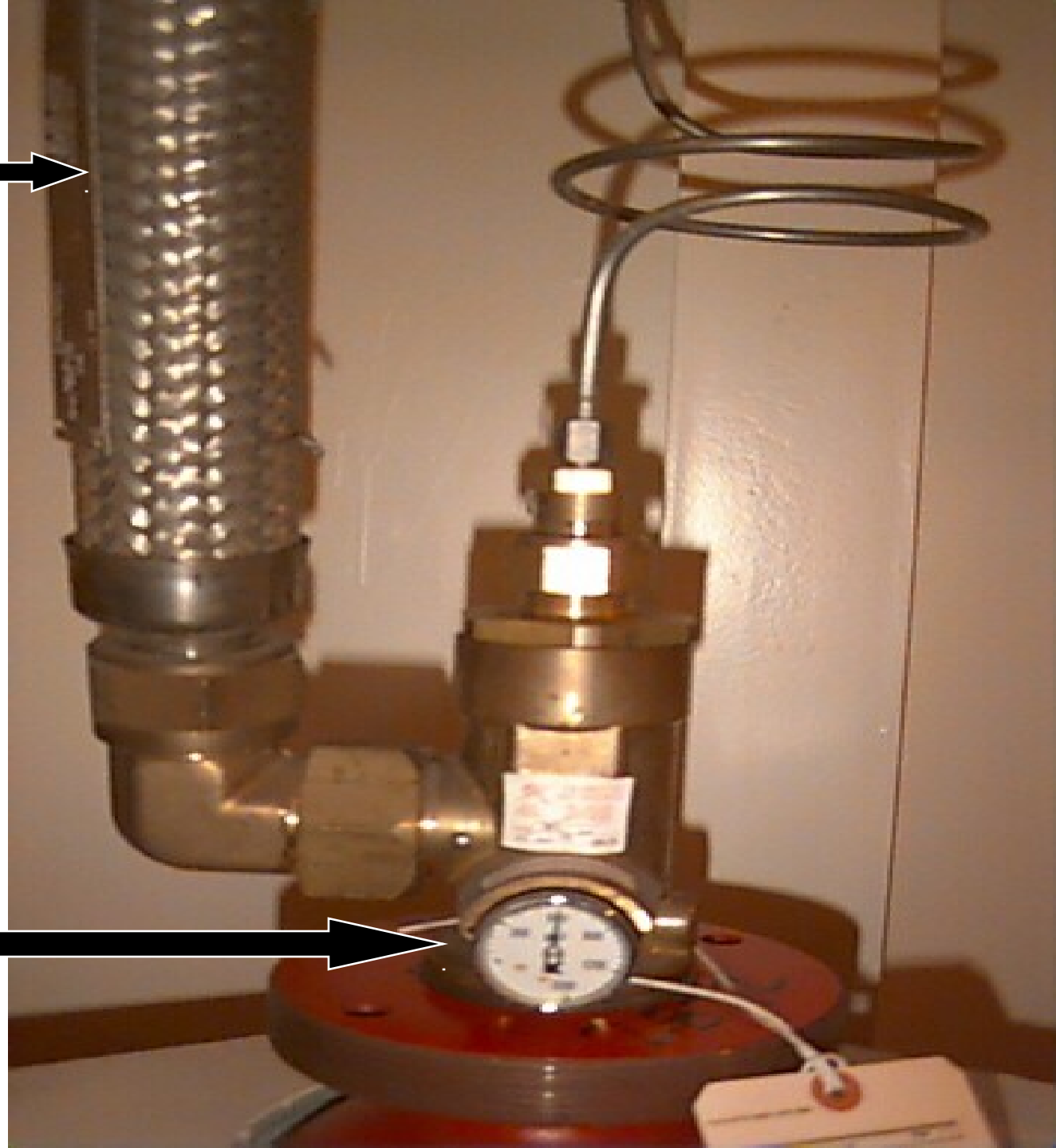
HALON 1301 SYSTEM COMPONENTS

- CYLINDER VALVE ASSEMBLY AND RUPTURE DISC
  - SPOOL TYPE VALVE
  - RUPTURE DISC RELIEVES AT 2650-3000 PSI (APPROX 240^{0}F)

ACTUATOR HEAD



Wire braided discharge hose



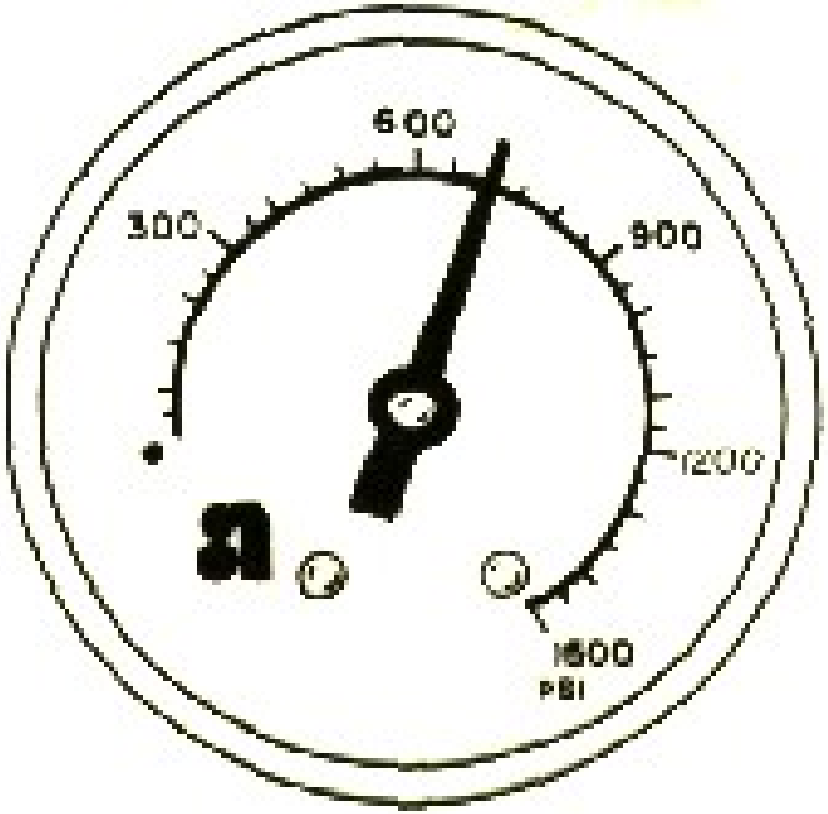
Pressure gage

HALON 1301 SYSTEM COMPONENTS

- CYLINDER PRESSURE GAGE
  - 0-1500 PSI
  - CYLINDER PRESSURE IS DIRECTLY PROPORTIONAL TO SPACE TEMP.
  - PMS REQUIRES INSPECTION OF CYLINDER PRESSURES MONTHLY

1. CORRESPONDING TEMPERATURE AND PRESSURE GRADUATIONS

TEMPERATURE	50°	70°	100°	125°	150°	175°	200°
PRESSURE	540	605	720	980	1320	1680	2020



HALON 1301 SYSTEM COMPONENTS

- HALON DISTRIBUTION PIPING AND NOZZLES
  - PROVIDES AGENT DISTRIBUTION THROUGHOUT SPACE
  - PIPING CONNECTED BY 1 1/2" STEEL BRAIDED FLEXIBLE HOSES
    - *HYDROSTATIC TESTING AT REGULAR INTERVALS PER FLEX HOSE MANAGEMENT PROGRAM NO LONGER REQUIRED / VISUAL INSPECTION ANNUALLY*

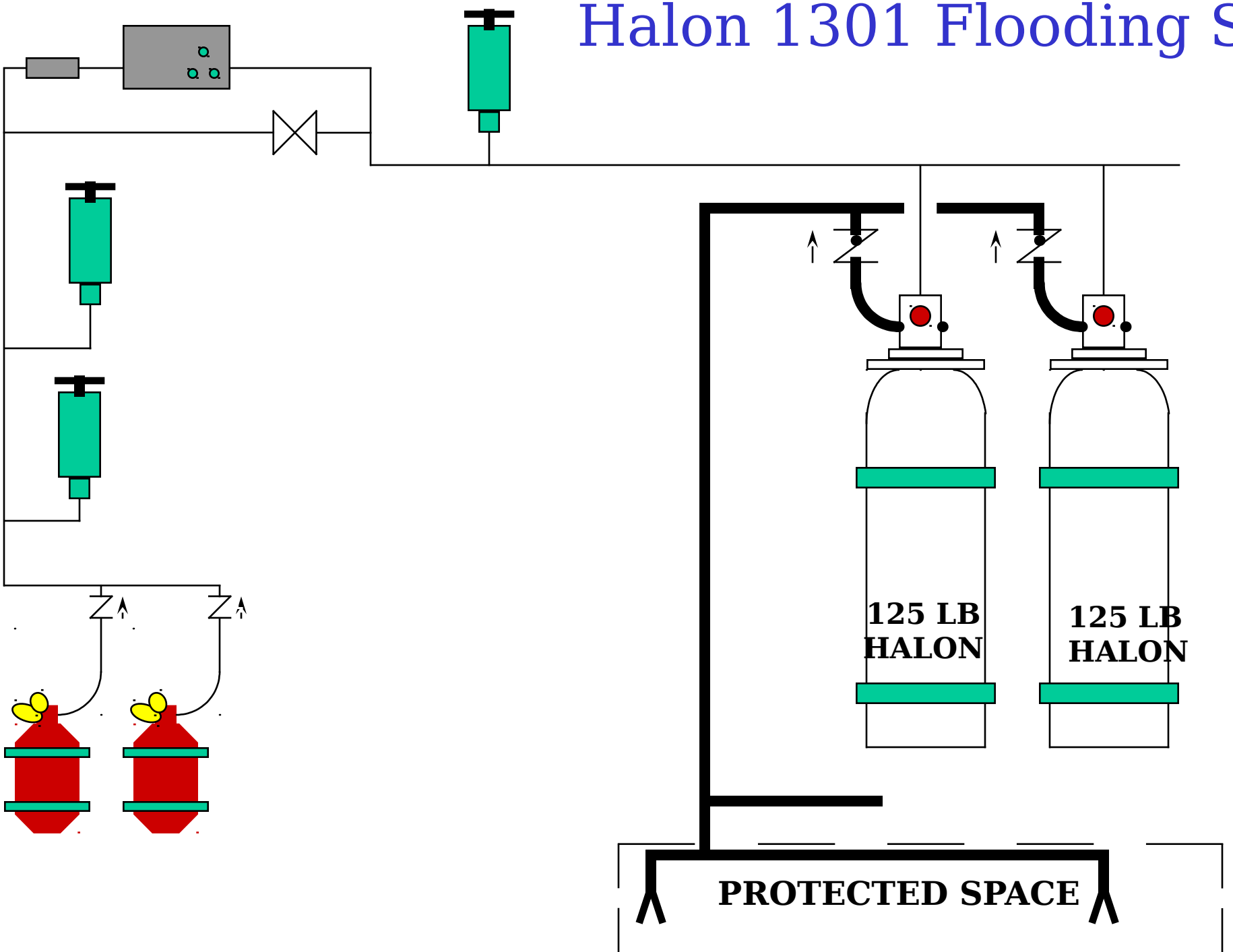
HALON 1301 SYSTEM COMPONENTS

- HALON DISTRIBUTION PIPING AND NOZZLES
  - NOZZLE ORIFICE AND BODY SIZE VARY DUE TO VOLUME OF SPACE PROTECTED AND NOZZLE LOCATION

HALON 1301

- SPACE RE-ENTRY REQUIREMENTS
  - 15 MINUTE SOAK TIME REQUIRED TO ALLOW FOR SPACE COOLING
  - OBA REQUIRED FOR ENTRY
  - FFE, BOOTS, GLOVES, FLASH GEAR, HELMET
  - 2 CHARGED AFFF HOSES

Halon 1301 Flooding Sy



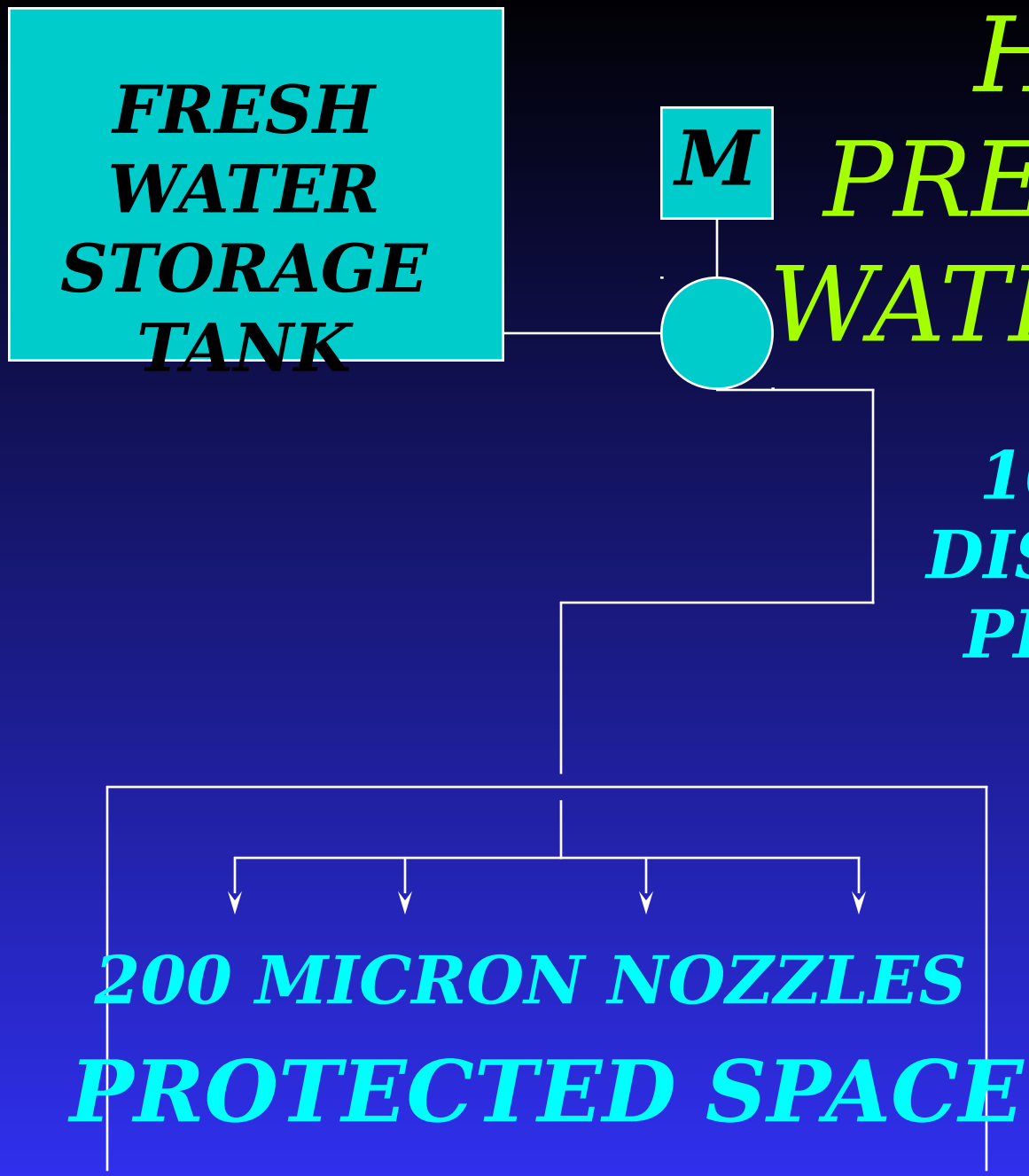
HALON-1301 vs FM-200

	HALON	FM-200
ODP	15	0
ATM LIFE	77	31
EFF %	3%	8.5%
RDC	5-7%	1
# OF CYL	12	23
WT/VOL	1	1.9
DECOMP TEMP	900^{0}F	1292^{0}F
LOAEL	7.5%	10.5%

FM-200

- SKED FOR INSTALLATION IN FLAMMABLE LIQUID STOREROOMS ON LPD-17 / CVN-76
- DESIGNATED HFC-227ea

HIGH PRESSURE WATER MIST



HIGH PRESSURE WATER MIST

- HIGH PRESSURE WATER SPRAY (1000 PSI) DELIVERED BY A POSITIVE DISPLACEMENT PUMP THROUGH 200 MICRON NOZZLES TO EXTINGUISH THE FIRE BY COOLING
- TESTED SUCCESSFULLY ABOARD EX-USS SHADWELL IN SEP98 DURING DAMAGE CONTROL AUTOMATION FOR REDUCED MANNING TESTING

HIGH PRESSURE WATER MIST

- DURING SHADWELL TESTING SPACE TEMP WAS REDUCED FROM 900^{0}F TO 130^{0}F ***WITHIN 30 SECONDS***
- <30 GAL WATER REQUIRED
- FIRE EXTINGUISHMENT WILL OCCUR IN SPITE OF OPEN ACCESS DOORS / CLOGGED OR BLOWN OFF NOZZLES (extinguishment time increased but occurred nonetheless)

HIGH PRESSURE WATER MIST

- TESTING INDICATES THAT EXTINGUISHMENT TIMES ARE *SHORTER* FOR LARGER FIRES
- WHEN FIRE WAS SMALL IN MAGNITUDE AND OBSTRUCTED ON 4 OF 6 SIDES EXTINGUISHMENT TIME DID NOT EXCEED 6 MINUTES

HIGH PRESSURE WATER MIST

- MINIMAL DAMAGE TO ELECTRICAL EQUIPMENT - PRELIMINARY TESTING BY HUGHES ASSOCIATES INDICATES THAT MIST SPRAY FAILED TO DAMAGE A PC FROM A DISTANCE OF 36 INCHES!
- SKED FOR INSTALLATION IN MAIN ENGINEERING SPACES ONBOARD LPD-17 / CVN-76

SUMMARY

- HALON IS A SEVERE OZONE DEPLETING SUBSTANCE
- ALL PRODUCTION OF HALON STOPPED IN 1994 / US NAVY HAS 1.6 MILLION LBS OF HALON 1301 IN RESERVE (30 YEAR SUPPLY)
- HALON 1211/ PORTABLE EXTINGUISHERS

SUMMARY

- HALON 1301
  - SYSTEM COMPONENTS
  - TYPES OF TOTAL FLOODING SYSTEMS
  - HAZARDS ASSOCIATED WITH USE
  - ALTERNATIVES

REVIEW QUESTION #1

- IF NO HALON DUMP ALARM IS RECEIVED 70 SECONDS FOLLOWING SYSTEM ACTIVATION WHAT ACTION SHOULD BE TAKEN?
- THE OPERATOR MUST OPEN THE TIME DELAY BYPASS VALVE

REVIEW QUESTION #2

- HOW CAN HALON EFFECTIVENESS BE DETERMINED FOLLOWING CLASS B FIRE EXTINGUISHMENT?
- TEMPERATURE OF SURROUNDING BULKHEADS
- CHANGE IN AMOUNT / COLOR OF SMOKE
- REDUCTION IN FIRE NOISE
- VISUAL INSPECTION THROUGH EOS / ESCAPE TRUNK WINDOWS

REVIEW QUESTION #3

- WHAT IS THE MINIMUM HALON SOAK TIME? WHY?
- 15 MINUTES
- ALLOW FOR SPACE COOLING

REVIEW QUESTION #4

- WHAT DO EACH OF THE HALON SYSTEM ALARM LIGHTS INDICATE?
- WHITE - POWER AVAILABLE TO ALARM SYSTEM
- AMBER - SYSTEM ACTIVATION HAS OCCURRED
- RED - HALON DISCHARGE

Installed Halon Systems

Unit 5.9